Universal 1-channel switching receiver RCM 255

User Manual V1.12
January 2007

Revision History

The following major modifications and improvements have been made to the initial version of the document (User Manual V1.0):

Version	Subject (major changes since last version)
V1.1	Relay output switching capabilities added (chapter 1.5)
V1.11	Power dissipation added
V1.12	Relay switching capabilities corrected

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Important!

This information describes the type of component and shall not be considered as assured characteristics. No responsibility is assumed for possible omissions or inaccuracies. Circuitry and specifications are subject to change without notice. For the latest product specifications, refer to the EnOcean website: http://www.enocean.com.

As far as patents or other rights of third parties are concerned, liability is only assumed for modules, not for the described applications, processes and circuits.

EnOcean does not assume responsibility for use of modules described and limits its liability to the replacement of modules determined to be defective due to workmanship. Devices or systems containing RF components must meet the essential requirements of the local legal authorities. The approval requirements described in this document are of best knowledge without any warranty.

The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.

Components of the modules are considered and should be disposed of as hazardous waste. Local government regulations are to be observed.

Packing: Please use the recycling operators known to you. By agreement we will take packing material back if it is sorted. You must bear the costs of transport. For packing material that is returned to us unsorted or that we are not obliged to accept, we shall have to invoice you for any costs incurred.

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1. GENERAL DESCRIPTION

The **1-channel switching receiver RCM 255** is a RF receiver designed to switch various 120V electronic loads such as incandescent lamps, high-voltage halogen lamps, electronic ballast and inductive loads upon receipt of authenticated radio packets sent by EnOcean transmitters. An EnOcean transmitter can simultaneously control an unlimited number of receivers. Each transmitter has its own fixed 32-bit address. The RCM 255 'LEARNS' the address of transmitters that are assigned to the receiver.

1.1 Basic Functionalities

Each RCM 255 can operate as either a Push Button Switch receiver (by LEARNING EnOcean PTM Switches) or a Magnet Contact Receiver (by LEARNING EnOcean STM 250 magnet contacts), but not a mix of devices. The RCM 255 can LEARN either a maximum of 30 EnOcean PTM's or up to 2 EnOcean STM 250's. The memory of the receiver is empty when delivered. By assigning the first transmitter the operating mode (push button switch or magnet contact) is defined. The operating mode can only be changed after deleting all learned transmitters with the CLR button.

a) Mode **ROCKER SWITCH**: Each assigned transmitter can be used to change the switching state of the receiver. It is possible to switch ON (button I) with one switch and to switch OFF (button O) with another switch. When learning a radio switch with 2-rockers, only the rocker which has been pressed is learned by the receiver.

b) Mode **WINDOW CONTACT**: If at least one of the assigned window contacts is open, the switching state of the receiver is ON. If both contacts are closed the state is OFF. The window contacts transmit a 'supervisory signal' approx. every 15min. If there has been no supervisory signal for more than 60 minutes, the RCM255 considers the contact closed.

Figure 1: 1-channel switching receiver RCM255

1.2 Typical Applications

- **Building installation**
- **Industrial automation**
- **Consumer Electronics**

The RCM switching receiver is part of a powerful RF system solution from EnOcean for operation and control applications. Because the RF transmitters are self-powered (no batteries), maintenance-free RF systems can be implemented.

The RCM switching receiver operates together with the following further EnOcean components: PTM (batteryless radio switches), STM 250 (batteryless radio window contact), CTM (remote control) and TCM (bi-directional IT interface)

1.3 Features Overview

Power Supply: .....120 VAC, 60 Hz
Power Dissipation: ..... 1300mW max.
Relay Output: .....maximum load 1100VA resistive (cosφ=1)
200W tungsten (incandescent lamp), 140W ballast with cosφ=0.4 – 0.6 (fluorescent lamp)
Radio Frequency: ..... 868.3 MHz (stabilized by crystal PLL)
Channel Bandwidth / Sensitivity: .....280 kHz / -95 dBm
Antenna: ..... internal whip antenna
Control Inputs: ..... 2 pushbuttons LRN (set receiver into learning mode) and CLR (clear all)
Learning Mode Indication: ..... acoustic feedback (switching noise of relay)
Number of RF transmitters learnable: .....up to 30 switches or up to 2 magnet contacts
Note: either PTMs or either STM250s can be learned, not mixed (for priority reasons)

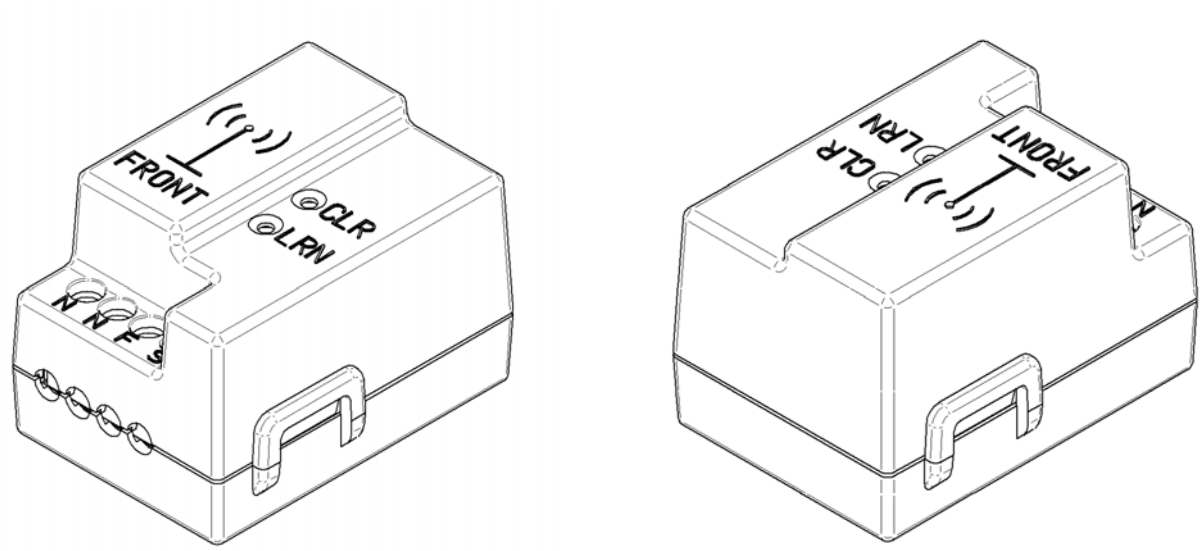


Figure 2: RCM 255 housing (without wiring)

1.4 Physical Dimensions

Dimensions of housing: ..... 48.4 x 37.1 x 32.4 mm
Tolerance values of the following outline drawings: ..... +/- 0.2 mm

Please note: The following drawings are without the factory installed wiring!

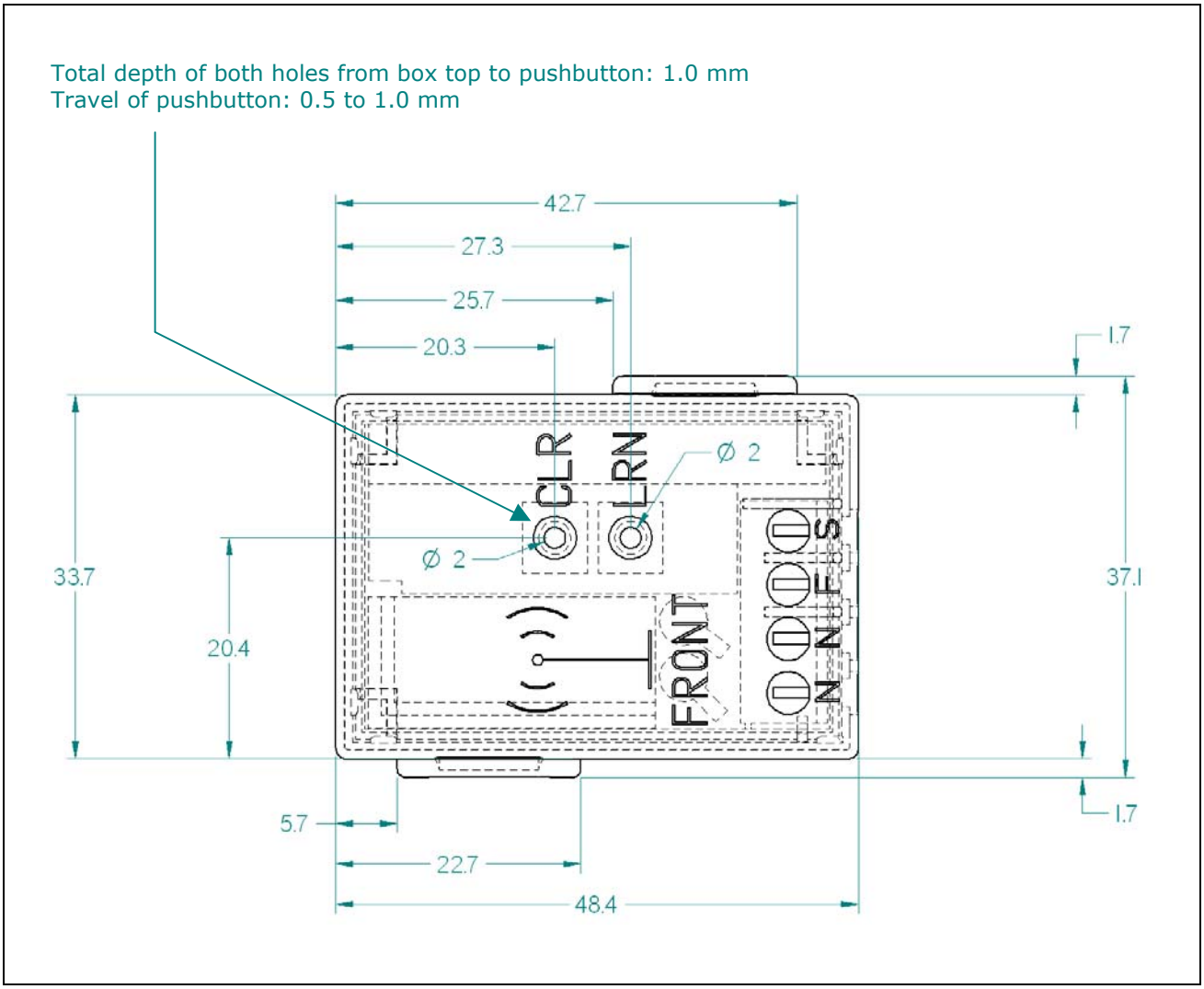


Figure 3: RCM 255 top view

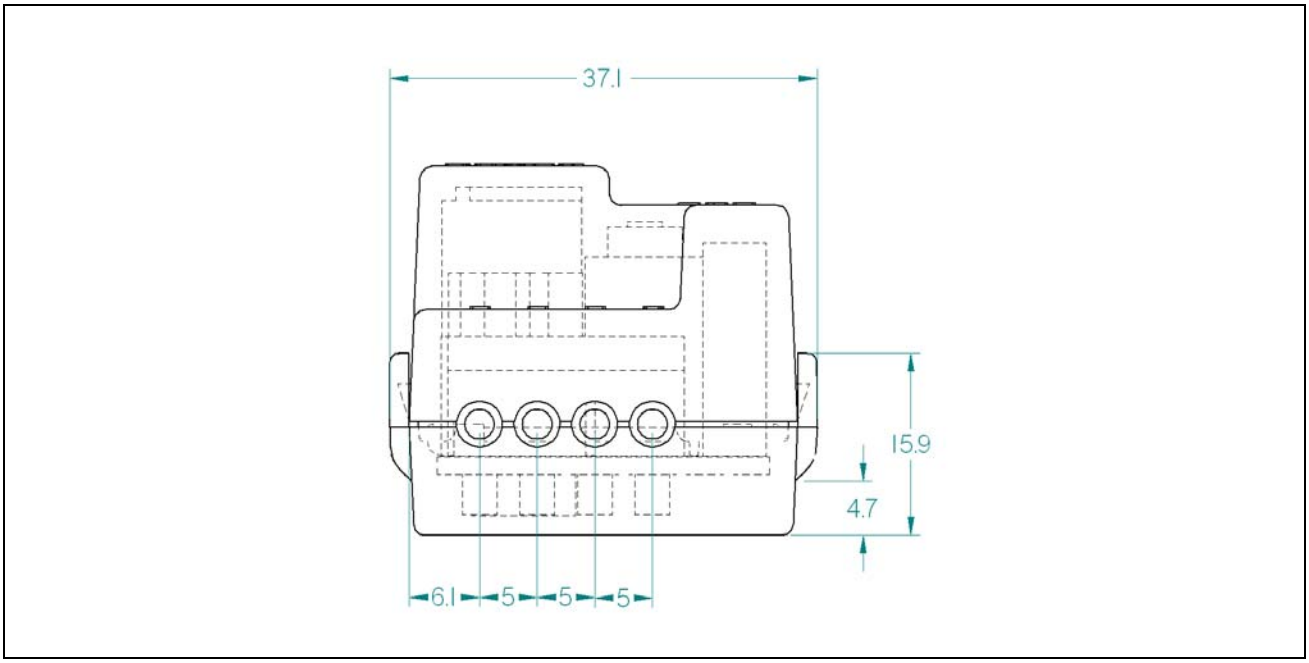


Figure 4: RCM 255 front view

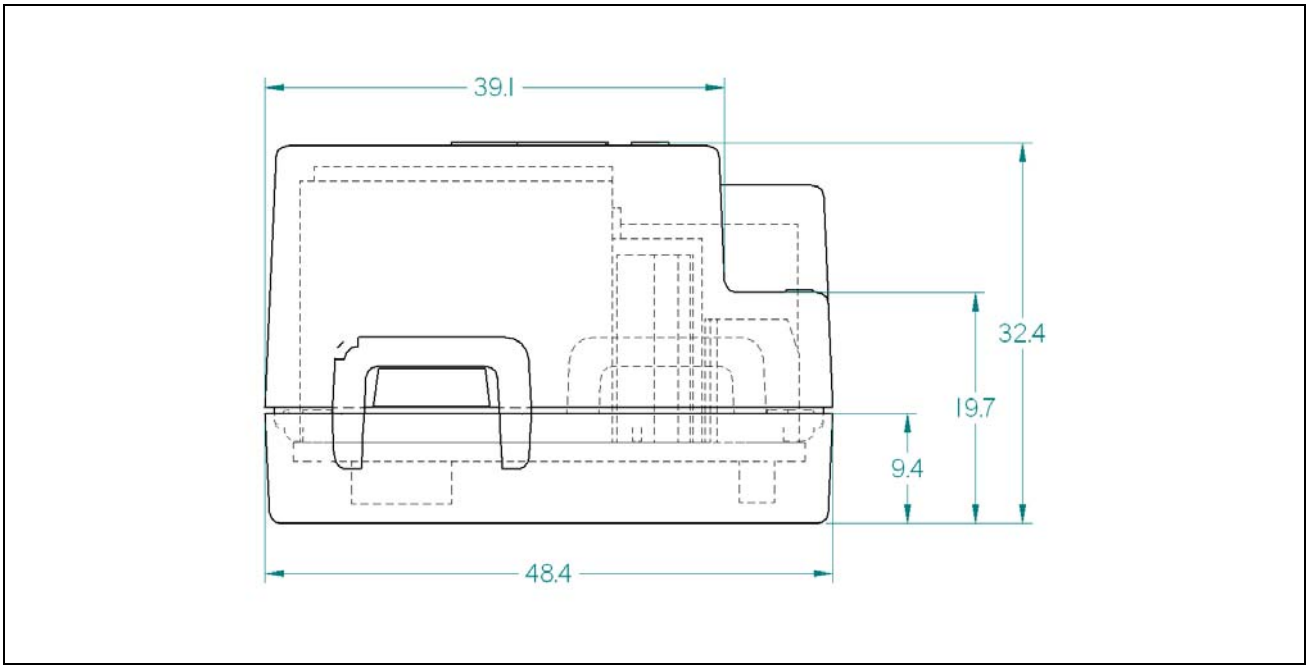


Figure 5: RCM 255 side view

1.5 Relay output switching capabilities

Kind of load		Maximum Load	Electrical life
Incandescent lamp 120V AC		2 x 100W	20.000 (according to EN60669)
Gas discharge lamps / HQL-HQI / not compensated*		60W	20.000
Gas discharge lamps / HQL-HQI / compensated*		50W (14µF)	20.000
EGC Dynamic / dimmer*		1 x 18W 1 x 36W	25.000
Halogen lamp 120V AC		80W	20.000
Fluorescent lamp 120V AC with conventional ballasts	Not compensated cosφ 0,4 – 0,6	12 x18W	25.000
		4 x 36W	25.000
		2 x 58W	25.000
	Compensated with capacitance in parallel	2 x 18W	20.000
		1 x 36W	20.000
	Compensated fluorescent DUO-circuit	2 x 18W	20.000
		1 x 36W	20.000
Fluorescent lamp 120V AC with electronic ballasts	Siemens / Osram EVG	4 x 18W	20.000
		2 x 36W	20.000
		1 x 58W	20.000
Resistive load 120V AC	cosφ=1	10A	Min. 50.000
Max. capacitance at 120V AC		14 µF	Min. 5.000 (according to EN60669)
Max. inrush current for max. 20ms at 120V AC		40 A	see above loads

1.6 Terminal Block and Wiring Description

Terminal Block: ..... 4 pole, terminal screw with wire guard
Rated torque/ screw size: ..... 0,4 Nm / M2,6
Max. rated cross section - Single wire (solid): ..... 1.5 mm^2
Max. rated cross section - Stranded wire (flex.): ..... 1.0 mm^2
Max. rated cross section - Stranded wire with ferrules: .....0.75 mm^2

For easiest installation the RCM 255 is delivered with factory installed wiring as follows:
Wiring: ..... 4 wires, stranded, gauge AWG16 (1.3mm), length 7" (18cm)
Color of wires: .....black for Hot, red for Load, 2 x white for Neutral (internally coupled)

The wire ends do have the plastic sheathing cut and partially pulled, but not fully removed to prevents the fraying of wires: Wire ends pre-stripped 0.6" (16mm) with ends left on, blank cable core 0.2" (5mm)

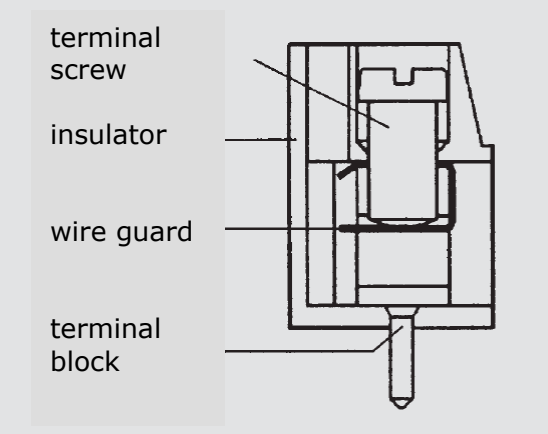


Figure 6: RCM 255 terminal block

1.7 Environmental Conditions

Operating Temperature:..... -10 up to +45 °C
Storage Temperature:..... -25 up to +80 °C
Humidity:..... 0 % to 95 % r.h., no condensing

1.8 Ordering Information

Type	EnOcean Ordering Code	Remarks
RCM 255	**H5002-B255**	120 VAC / 60Hz

2. FUNCTIONAL DESCRIPTION

2.1 Block Diagram

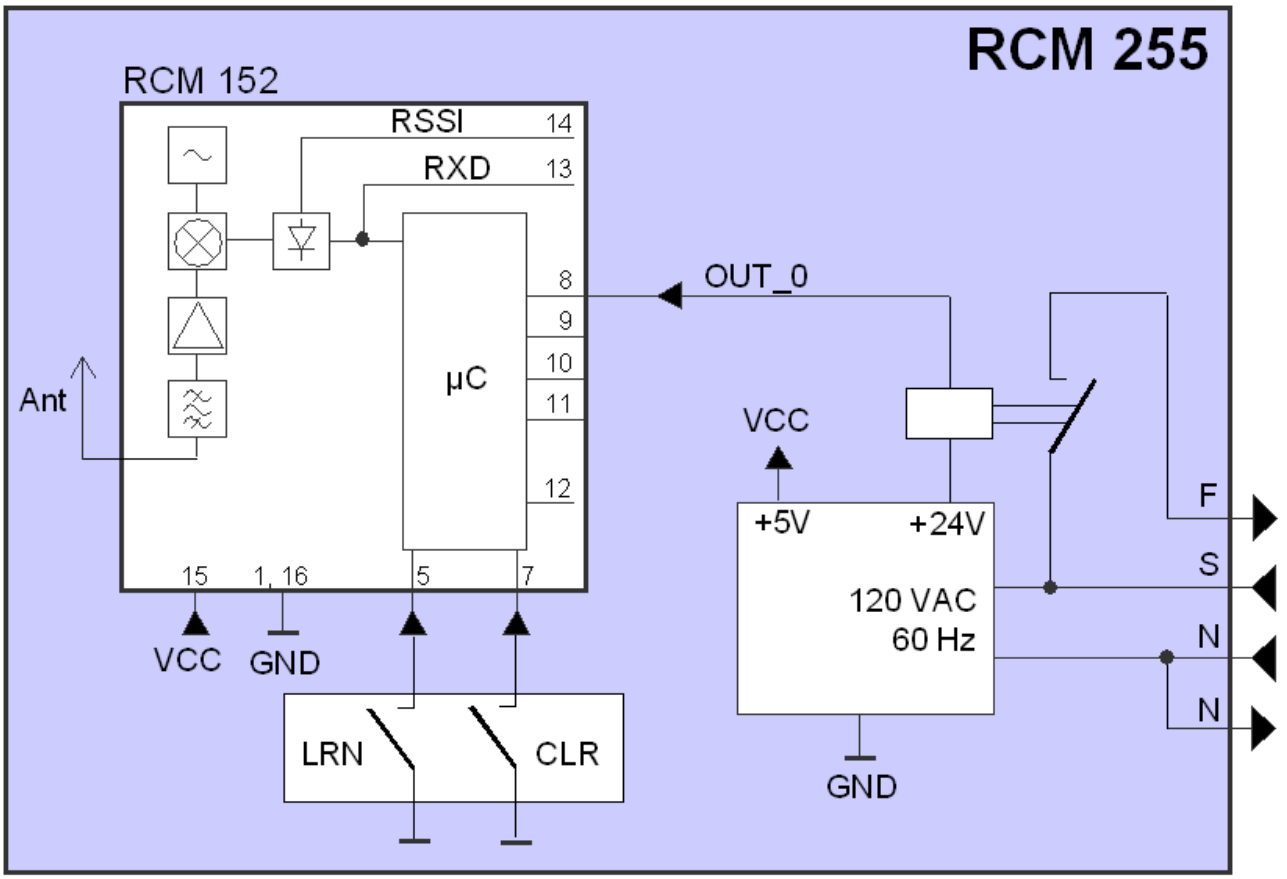


Figure 7: Block diagram of RCM 255

2.2 Wire Description

Symbol	Wire Color	Function	Operational characteristics
F	**red**	Fixture	Relays output switched to Hot
S	**black**	Hot	Power Supply 120 VAC, 60 Hz
N	**white**	Neutral	Power Supply 120 VAC, 60 Hz
N	**white**	Neutral	Internally coupled to second white wire

2.3 Operating Mode

Each RCM 255 can operate as either a Push Button Switch receiver (by LEARNING EnOcean PTM Switches) or a Magnet Contact Receiver (by LEARNING EnOcean STM 250 magnet contacts), but not a mix of devices. The RCM 255 can LEARN either a maximum of 30 EnOcean PTM's or up to 2 EnOcean STM 250's. The memory of the receiver is empty when delivered. By assigning the first transmitter the operating mode (push button switch or magnet contact) is defined. The operating mode can only be changed after deleting all learned transmitters with the CLR button.

a) Mode ROCKER SWITCH: Each assigned transmitter can be used to change the switching state of the receiver. It is possible to switch ON (button I) with one switch and to switch OFF (button O) with another switch. When learning a radio switch with 2-rockers, only the rocker which has been pressed is learned by the receiver.

> ***Initialization:*** After Power-up and Learning Phase the relays output is open ("off"). At least one of the learned radio switches have to be operated to switch the output.

b) Mode WINDOW CONTACT: If at least one of the assigned window contacts is open the switching state of the receiver is ON. If both contacts are closed the state is OFF.

> ***Time Out:*** If at least one of the assigned window contacts is open, the switching state of the receiver is ON. If both contacts are closed the state is OFF. The window contacts transmit a 'supervisory signal' typically every 15 min (5…30 min). If there has been no supervisory signal for more than 60 (± 10%) minutes, the RCM 255 considers the contact closed.
> Potential reasons the supervisory signal is not received include: The energy store of the window contact is empty, make sure the solar cell receives sufficient light, the radio channel is disturbed by interference or obstructions, the window contact has been removed, or the contact is broken
>
> ***Initialization:*** After Power-up and Learning Phase the module output OUT_0 is inactive ("off"). At least one of the learned magnet contacts have to be opened to release the output immediately (before first incoming presence signal).

2.4 Learning of Radio Transmitters

1.) For programming the RCM255 must be connected to power. The programming is retained when power is disconnected. To prevent LEARNING unintentional switches, when in Programming mode, the receiver sensitivity is reduced to approximately 5 meters from the switch.

2.) Operating the LRN or CLR pushbutton should be done by pushing a non-metallic insulated probe (e.g. plastic ballpoint pen) carefully through the small hole in the housing onto the pushbutton behind.

3.) Press and hold the LRN button approximately 0.3 seconds until Programming mode activates which is confirmed by 1 second cyclic switching of the output relays ("Toggling"): A light connected to the power output will be switched on and off every second. In quiet environments the Toggling of the relay can be heard.

4.) Transmitters can now be LEARNED: By pressing one of the rockers of a PTM radio switch or by pressing the learn button inside the back cover of the STM250 magnet contact, the transmitter is assigned to the switching receiver, and the relay stops Toggling for about 4 seconds. The relay status confirms that the transmitter has been saved (contact remains on for 4seconds) or a previously learned transmitter is deleted (contact 4s off).

5.) As soon as the Toggling of the relays resumes, additional transmitters can be LEARNED or deleted. If the RCM255's memory is full (30 EnOcean PTM 250 radio switches or 2 EnOcean STM 250 radio window contacts) the receiver terminates Programming mode and returns to operating mode during an attempt to enter another transmitter. In this case at least one ID has to be deleted before LEARNING a new transmitter.

6.) To exit Programming mode, re-press the LRN button, or after 30 seconds of no activity the receiver automatically exits Programming mode.

2.5 Selective Deleting

A transmitter that has been LEARNED can be selectively deleted. The Programming mode is activated by pressing the LRN button. Then actuate the rocker or learn button of a previously learned transmitter, it is now UNLEARNED. Exit Programming mode by repressing the LRN button.

2.6 Clear All

If the CLR key is pressed and held for approx. 2 seconds the memory is deleted completely (condition upon delivery). Then the RCM255 receiver enters Programming mode which is signalled by the Toggling output relays. Programming mode is left manually by pressing the LRN button.

3. APPLICATIONS INFORMATION

3.1 Installation

1.) WARNING: To avoid fire, shock, or death: TURN OFF POWER at circuit breaker or fuse and test that power is off before wiring!
2.) For in-wall mounting an outlet box must be used. For best performance do not mount the receivers close to the floor or near to wall niches. Do not mount the receiver into a metal housing.
3.) Prepare wires: Pull off pre-cut insulation from RCM255 leads. Make sure that the wires are not frayed, cut if necessary removing 5/8" (1.6cm) of insulation from each wire.
4.) Connect wires per EXAMPLE CIRCUIT as follows: Both white wires are coupled internally (N). Screw wire nuts on clockwise making sure no bare conductors show below the wire connectors. Secure each connection with electrical tape.
5.) Installation may now be completed by carefully positioning all wires and stowing the receiver box. Restore power.

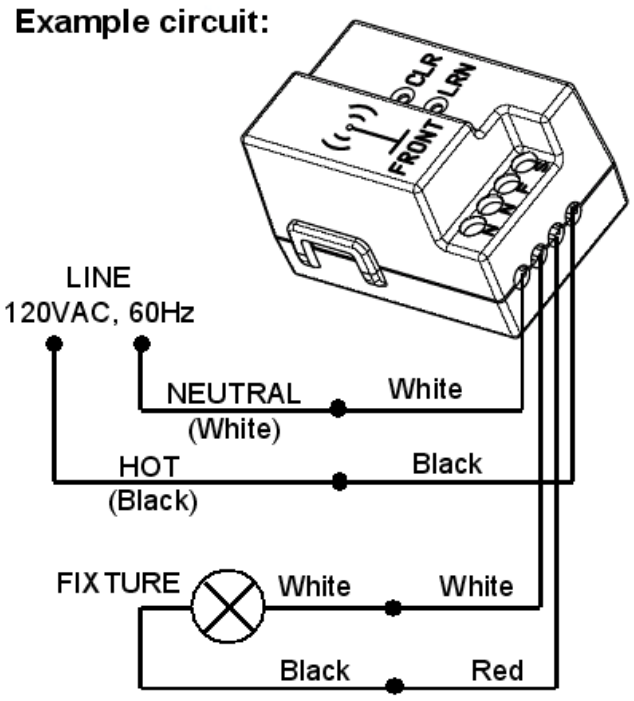


Figure 8: RCM 255 Example Circuit

The integrated ¼-wave whip antenna enables a very compact receiver unit with good radio reception characteristics. **For good receiver performance take attention to the factors restricting transmission range mentioned in the next both chapters**.

Please note that the **best range performance can be received by facing EnOcean**

transmitters to the RCM 255 receiver casement top position (see antenna marking on cap). This is a result of the internal antenna position that can be seen in the following picture:

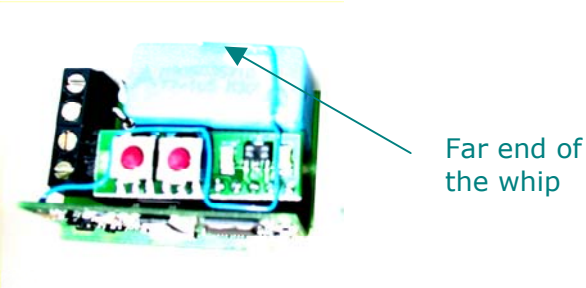


Figure 9: Internal position of the RCM 255 whip antenna

3.2 Mounting RCM 255 Near To Metallic Objects

For range performance a minimum distance of 1 cm, better 2 cm, should be given from the whole length of the antenna to any conductive objects. Mainly the far end of the whip should be mounted as far away as possible from all metal parts.

The internal position of the antenna is shown in Figure 9.

Please note that large metallic parts or conductive objects in the transmission direction causes shading of the radio waves that could result in range reduction. Using a suited placed repeater is a prospective remedial measure.

Do not mount the receiver into an enclosed metal housing.

3.3 Transmission Range

Since the radio signals are electromagnetic waves, the signal is attenuated on the way from the transmitter to the receiver. This means that the field intensity diminishes as the distance between the transmitter and the receiver increases, and radio range is restricted. Obstacles between devices can also reduce the range.

In practice, this means that the materials used in the building play an important role when an assessment of the radio range is made. Some standard values for helping in assessing the environment:

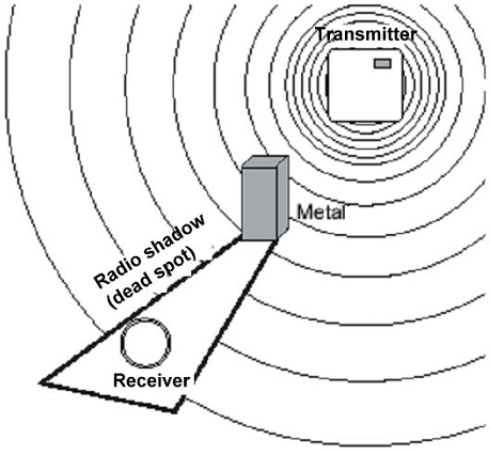
- ***Line-of-sight connections:*** Typically 30m range in corridors, up to 100m in halls
- ***Plasterboard walls / dry wood:*** Typically 30m range, through max. 5 walls
- ***Brick walls / aerated concrete:*** Typically 20m range, through max. 3 walls
- ***Ferroconcrete walls / ceilings:*** Typically 10m range, through max. 1 ceiling

- ***Fire-safety walls, elevator shafts, staircases and supply areas should be considered as screening***.

Other factors restricting transmission range:

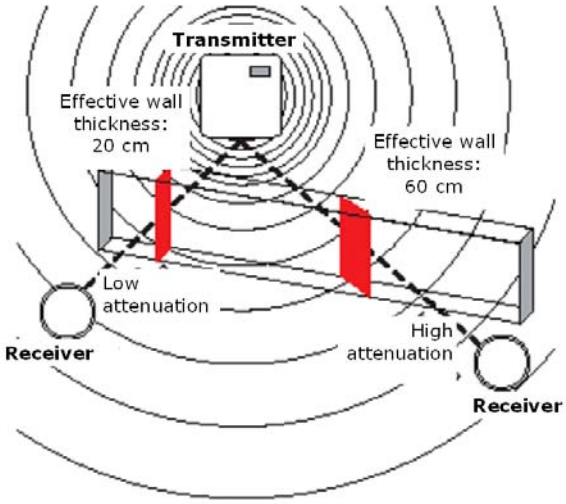
- **Switch mounted on metal surfaces (up to 30% loss of transmission range)**
- **Hollow lightweight walls filled with insulating wool on metal foil**
- **False ceilings with panels of metal or carbon fiber**
- **Lead glass or glass with metal coating, steel furniture**
- **Mounting transmitter or receiver on the floor, or close to the floor, or at wall niches**
- **Humidity in materials**
- **Devices transmitting RF signals such as computers, audio and video equipment, or electronic gear controls for lamps. A minimum distance of 0.5m should be kept**

The angle at which the transmitted signal hits the wall is very important. The effective wall thickness – and with it the signal attenuation – varies according to this angle. Signals should be transmitted as directly as possible through the wall. Wall niches should be avoided.



Penetration of radio signals

Material	Penetration
Wood, plaster, uncoated glass	90...100%
Brick, fiberboard	65...95%
Ferroconcrete	10...90%
Metal, aluminum facings	0...10%



Figures 10 and 11: Obstacles reducing the transmission range

Please note: 868 MHz frequency range is used by Trunk Radio in the US. Since a clear reduction of transmission range is to be expected near to trunk radio stations, range tests at the system's target location should categorically be performed before notification of a particular range in the US and Canada!

3.4 FCC/IC Approval

This device complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada. If this device is operated in compliance with the following requirements **it can be operated without notification and free of charge in the area of the United States of America and in Canada**.

Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Trade Name: RCM 255
Model No: RCM 255

FCC ID: SZV-RCM255
IC: 5713A-RCM255

This device complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada. Operation is subject to the following two conditions. (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Warning: Changes or modifications made to this equipment not expressly approved by EnOcean may void the FCC authorization to operate this equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Due to FCC 15.231 operational and timing requirements the **PTM switch device must not be operated more than 1088 times per hour** (pushed or released as one operation each):

- Total duration of transmissions must not exceed more than two seconds per hour
- PTM 200 packet length is 0.7 ms, max. 5 redundant packets, tolerance of 5% in packet length, 50% on average packet Ton/Toff ratio

Due to FCC 15.231 operational and timing requirements, the **STM 250 magnet contact must not be operated more than 1414 times per hour** (opened or closed):

- Total duration of transmissions must not exceed more than two seconds per hour
- STM250 packet length is 0.9 ms, 3 redundant packets, tolerance of 5% in packet length, 50% on average packet Ton/Toff ratio

3.5 cCSAus Approval

This device complies with CSA C22.2 No.14 and UL 508. It can be operated without notification in the area of the United States of America and in Canada

3.6 Field Intensity Meter EPM 100

The EPM100 is a mobile field-intensity meter that helps the engineer to find the best installation positions for sensor and receiver. It can also be used to check disturbances in links to already installed equipment. **The EPM 100 can be used to identify 868 MHz trunk radio!**

The EPM100 displays the field intensity of received radio telegrams and interfering radio signals in the 868MHz range.

The simplest procedure for determining the best installation positions for the radio sensor/receiver:

- Person 1 operates the radio sensor and generates pushbutton radio telegrams.
- Person 2 checks the received field intensity on the meter display to find the optimal installation position.

Figure 12: EPM 100 helps to qualify installation positions

4. CERTIFICATE OF CONFORMITY

CETECOM ICT Services GmbH
Untertürkheimer Strasse 6-10, D-66117 Saarbrücken, Germany

Conformity Assessment Body
Certification Body at Industry Canada

CERTIFICATE OF CONFORMITY

Certificate Holder:	**EnOcean GmbH** **Kolpingring 18a** **82041 Oberhaching** **Germany**
Model Identification:	**RCM255**
Equipment Category:	**Receiver**
Standards and Specifications:	**RSS210 Issue 6**
OATS Facility:	**Cetecom ICT Services GmbH** **Untertuerkheimer Str. 6-10** **66117 Saarbruecken** **Germany**
OATS Facility ID:	**3463**
IC Certification Number:	**5713A-RCM255**
Frequency Range:	**868.3 MHz**
Emission Designator:	**A1D**
Maximum Field Strength:	**n/a**
Antenna Information:	**Internal wired antenna**
Cetecom Registration No:	**2-3928/05**

Certification of equipment means only that the equipment has met the requirements of the above noted specification. License applications, where applicable to use certified equipment, are acted on accordingly by the issuing office and will depend on the existing radio environment, service and location of operation. This certificate is issued on condition that the holder complies and will continue to comply with the requirements of the radio standards specifications and procedures issued by Industry Canada.

This certificate is issued on condition that the holder complies and will continue to comply with the requirements of the radio standards specifications and procedures issued by the Department.

The Bureau will record the details of all certifications in the Department's Radio List (REL). Certified equipment shall not be distributed, leased, sold, offered for sale in Canada before the details of this certification have been added to the REL. URL: <http://strategis.ic.gc.ca/sitt/reltel/search/newRadioSearch.do?language=eng>

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Joachim Seewald
Signature:

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